

# Air Force Research Laboratory|AFRL

*Science and Technology for Tomorrow's Aerospace Forces*

## **Materials and Manufacturing Directorate**

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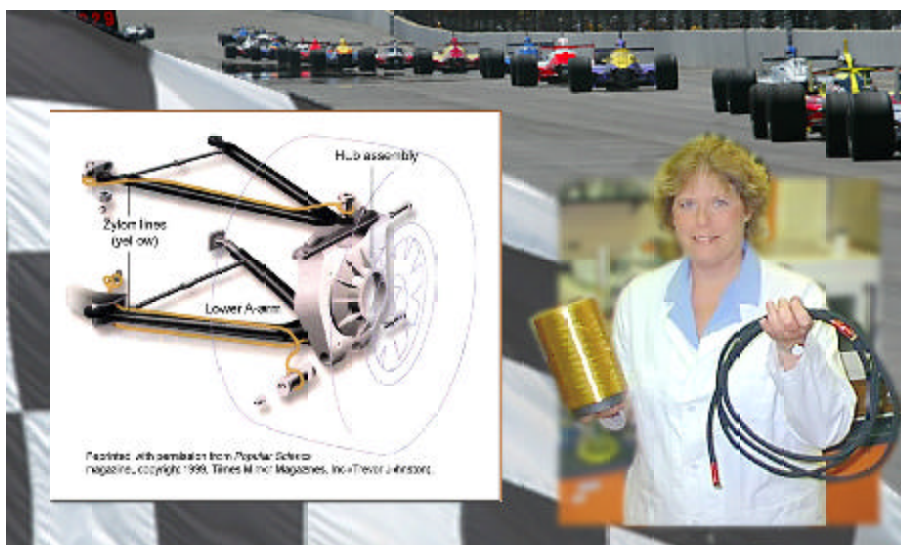
## **Material Developed by the Air Force Protects Auto Racing Spectators From Flying Debris**

Tethers used to keep tires and wheel assemblies attached to racecars when they crash were produced from technology developed by Air Force scientists and engineers. These people, who work at the Air Force Research Laboratory Materials and Manufacturing Directorate, originally developed this material for high temperature Air Force needs. These include flame retardant flight suits, aircraft seat covers, and heat and flame resistant clothing.

The material they developed, Polybenzobisoxazole (PBO), is known commercially as Zylon™, and is now used in a wide variety of commercial products, including tires, belts, hoses, plastics, concrete, gaskets, ballistic flak vests, cut and abrasion resistant safety gloves, and protective clothing for firefighters. It also helps protect drivers and spectators from injury and death when wheel components fly out of control at major racing events such as the "Indianapolis 500."

After PBO was developed by the Air Force, research continued for nearly 20 years before reproducible polymer products could be fabricated. Brunswick Defense Co., now Lincoln Composites of Lincoln, Neb., developed the composite to use in natural gas storage containers. They also wanted to use the material for breathing air tanks for firefighters, gas containers for inflating car airbags, aircraft emergency exit escape slides, and for fuel tanks. Toyobo Co. Ltd., Osaka, Japan, expanded PBO's commercial presence under the Zylon™ name to several product forms, including the form used in fabricating the race car tether.

Known as the "Safety Wheel Energy Management System" (SWEMS), the safety tether system is designed to keep tires and wheel assemblies attached to the car in the event of an accident. Similar in design to steel cables used to support large suspension bridges, SWEMS cables consist of approximately 10,000 individual PBO fibers. The fibers are grouped into bundles, intertwined to provide additional strength and stiffness, and wrapped in a protective polyester sheath that keeps the cable from unraveling. Each fiber is composed of high strength filaments, which can only be seen under a microscope. The cables will stretch, but are not long enough to snap back and hit the driver. Even if the wheel becomes detached, these tethers will reduce its energy and velocity, reducing the risk of injuries.



For more information on the Materials and Manufacturing Directorate  
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